

## Conic Sections: The Parabola

**Symmetric about the y-axis:  
(opens upward or downward)**

Standard Form:  $x^2 = 4py$

Vertex:  $(0, 0)$

Axis of symmetry:  $x = 0$

Focus:  $(0, p)$

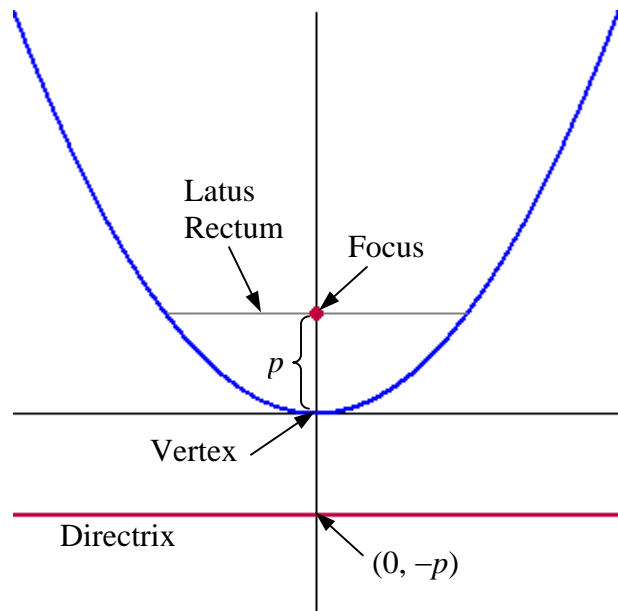
Directrix:  $y = -p$  (horizontal)

Focal Diameter:  $|4p|$

Eccentricity = 1

If  $p > 0$  the parabola opens upward

If  $p < 0$  the parabola opens downward



**Symmetric about the x-axis:  
(opens rightward or leftward)**

Standard Form:  $y^2 = 4px$

Vertex:  $(0, 0)$

Axis of symmetry:  $y = 0$

Focus:  $(p, 0)$

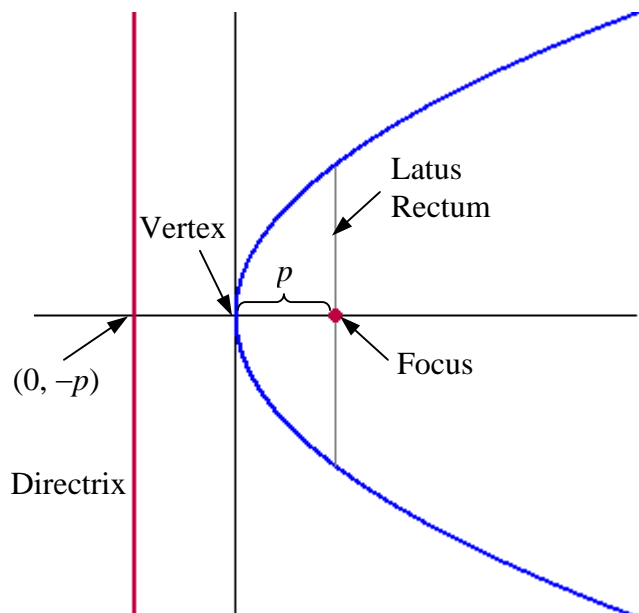
Directrix:  $x = -p$  (vertical)

Focal Diameter:  $|4p|$

Eccentricity = 1

If  $p > 0$  the parabola opens rightward

If  $p < 0$  the parabola opens leftward



Miscellaneous facts:

1. The vertex is always the midpoint between the focus and the directrix.
2. The axis of symmetry always passes through the focus and the vertex.
3.  $|p|$  is the distance between the vertex and the focus.
4. The parabola always bends around the focus.
5. The directrix is perpendicular to the axis of symmetry.
6. The eccentricity for a conic section is defined as the ratio  $PF/PD$ , where  $PF$  is the distance from any point on the curve to the focus, and  $PD$  is the distance from that same point to the directrix. By definition of a parabola, these distances are always equal, so the ratio is always 1.